49-5.0 ROADSIDE BARRIER APPLICATIONS

Some of the major factors to consider in the lateral placement of a roadside barrier include the following:

1. clearance between barrier and hazard being shielded to allow for deflection of the barrier;

2. effects of terrain between the edge of the traveled way and the barrier on the errant vehicle's trajectory;

3. probability of impact with barrier as a function of its distance off the traveled way;

4. flare rate and length of need of transitions and approach barriers; and

5. the need to offset guardrail and concrete barrier from the edge of shoulder so that the full shoulder width can be used. On new construction, the desirable guardrail offset is 0.6 m from the effective usable shoulder width and the minimum guardrail offset is 0.3 m from the effective usable shoulder width. On reconstruction projects, the desirable guardrail offset is 0.6 m from the effective usable shoulder width and the minimum guardrail offset is 0 m from the effective usable shoulder width. However, if the design year AADT exceeds 100,000, the guardrail offset should be 0.6 m from the effective usable shoulder width.

49-5.01 Lateral Placement

49-5.01(01) Barrier Offset

A roadside barrier should be placed as far from the traveled way as conditions permit, thereby minimizing the probability of impact with the barrier. The roadside barrier should be placed beyond the shyline offset; see Section 49-5.02(01).

The designer should evaluate the practicality of offsetting the guardrail or CMB more than 0.6 m beyond the edge of the required shoulder width. This assessment must include a comparison of the additional costs of all items such as benching, borrow and grading needed to construct the flat slopes required to install barrier on the embankment, against the reduced cost of installation and maintenance of the lesser amount of barrier which would be required by locating it farther from the roadway. This assessment should also consider the location's accident history and the area's maintenance records regarding the repair of nuisance impacts.

At an installation of guardrail for a large culvert on a 4R project constructed on new alignment, the shoulder should not be paved to the face of the guardrail. The regular width of stabilized shoulder should be specified.

A width of 1 m (0.39 m of guardrail plus 0.61 m behind the guardrail) should be used from the front face of the guardrail to the shoulder break point.

49-5.01(02) Shoulder Section

On an INDOT route, the outside shoulder is paved to the face of guardrail if the face of the rail is located 3.8 m or less from the edge of the travel lane. On a local public agency project, the shoulder section at guardrail locations may be designed as follows:

1. Where the face of the guardrail is less than 0.6 m from the outside edge of the paved shoulder, the shoulder should be paved to the face of the guardrail.

2. Where the face of the guardrail is greater than 0.6 m from the outside edge of the paved shoulder, the width of the paved shoulder may remain the same as in the sections without guardrail.

49-5.01(03) Barrier Deflection

If the distance between the face of guardrail and the face of an isolated hazard is less than the dynamic deflection distance as shown in Figure 49-5A, it will be necessary to reduce the post spacing to obtain a dynamic deflection distance that is less than the clearance between the face of guardrail post and the face of object. If this is not practical, either the object or the guardrail should be moved to provide adequate deflection distance. It should be noted that the CMB does not deflect.

The deflection distances for thrie-beam guardrail are shown, but they should only be used at problem or special locations.

The deflection distances for type B guardrail are given so that the designer can analyze existing installations to determine whether or not existing deflection distances are sufficient.

b. Guardrail Height. The design height of guardrail should be maintained across the slope to the point where the guardrail passes over the foreslope/backslope intercept. Where this is not practical and if the gap between the ground and the bottom of the W-beam rail is 500 mm or more, it will be necessary to add a W-beam rub rail. The rub rail should be added for 15.24 m downstream and 7.62 m upstream of the area where the gap exceeds the 380-mm normal height. The W-beam rub rail should be terminated behind the last post, similar to that shown for a Type VH transition in the INDOT *Standard Drawings*.

c. Anchors. The end of the guardrail buried in the backslope will be anchored with a W-beam steel post anchor system as shown in the INDOT *Standard Drawings*.

d. Transitions. A foreslope transition zone will be needed to transition from the standard ditch cross-section in the cut section to the 10:1 desirable, 6:1 maximum, foreslope in front of the guardrail. The approach slope to the 20:1 cross slope in front of the guardrail should be a 30:1 maximum longitudinal slope relative to the roadway grade. The ground can then be warped from the standard ditch cross-section to the desired 10:1 foreslope in front of the guardrail. These conditions, if met, should minimize the potential for a vehicle to vault over the guardrail or for wheels to snag on the guardrail.

e. Drainage. Where a special ditch section providing the recommended guardrail approach terrain cannot be constructed without blocking flow in the ditch or where the resulting ditch grade is too slight, an acceptable inlet type and an outlet pipe will be required to carry the drainage under the guardrail. Even where an inlet is not needed in the vicinity of the guardrail because of approach terrain requirements, there may be a need for a drainage structure behind the guardrail in the fill section to prevent erosion.

9. Drive-Behind. If an errant vehicle penetrates the guardrail end treatment section, the driver should be able to guide the vehicle down the slope without problems. Therefore, a minimum recovery area behind the barrier end treatment must be provided. This recovery area is depicted in Figure 49-5Q.

49-5.04(04) Design Procedure

After the design of a roadside barrier is completed, including the appropriate railing transitions and the determination of the barrier length of need in accordance with Section 49-5.0, it is necessary to select the proper guardrail end treatment type (MS, OS, I, or II) for the guardrail in accordance with Section 49-5.04(01).

In order to determine the appropriate type of GRET, the following information should be considered:

1. Relationship of Guardrail End Treatment to Traffic. The designer must determine if there will be traffic on one or both sides of the guardrail end treatment. Will the GRET be located beyond the outside shoulder with traffic passing on one side only or will it be in a median, gore, or other location where traffic passes on two sides? If all traffic will pass a GRET only on one side, the GRET will not require redirective capability on more than one side. If traffic will pass the GRET on two sides, it may be necessary for the GRET to be capable of redirecting errant vehicles from two sides.

   a. GRET for Single-Faced Guardrail. For this situation, the GRET must provide redirective capability only on the traffic side. GRET type OS or type II should be selected for this situation.

   b. GRET for Double-Faced Guardrail. For this situation, the GRET must provide redirective capabilities on both sides. GRET type MS should be selected for this situation.

   c. Guardrail End Treatment Along a Local Public Agency Route Where the Design Year ADT < 1000. For this situation, the GRET Type I may be selected regardless of the design speed. Double-faced Guardrail End Treatment type I may be used in conjunction with double-faced guardrail. However, GRET Type I shall not be used on the National Highway System.

2. Relationship Between Guardrail End Treatment and Guardrail Length of Need. Some GRETs can function as typical guardrail as described below.

   a. GRET Type OS. An 11.43-m portion of the downstream end of a GRET type OS can function as typical guardrail and can be considered as part of the length of need in advance of the obstruction. Therefore, where GRET type OS is warranted, the pay length for the guardrail run is equal to the required length of need for the guardrail minus 11.43 m.

   b. GRET Type MS. A 3.81-m portion of the downstream end of a GRET type MS can function as typical guardrail and can be considered as part of the length of need in advance of the obstruction. Therefore, where GRET type MS is warranted, the pay length for the guardrail run is equal to the required length of need for the guardrail minus 3.81 m.

   These reduced pay lengths are to be reflected in the guardrail lengths shown on the plans.